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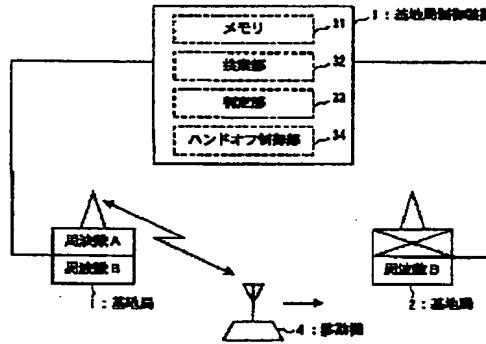
(54) HAND-OFF METHOD AND DEVICE IN CDMA  
CELLULAR SYSTEM

(57) Abstract:

PROBLEM TO BE SOLVED: To execute inter-frequency hand-off for frequency layers prepared by both a connecting cell and a mobile destination cell without the use of an accessory at a frequency layer border.

SOLUTION: A discrimination section 33 discriminates whether or not an operating frequency is resident at a frequency layer border in response to a deterioration report of the operating frequency from a mobile set 4, and when the operating frequency is resident in the frequency layer border, a retrieval section 32 retrieves a frequency layer prepared by both a communication state cell and an adjacent cell, a hand-off control section 34 uses the retrieved frequency to execute inter-frequency hand-off in the communication state cell and also executes inter-cell hand-off in response to the notice of the mobile destination cell from the mobile set 4 based on a strength measurement result of a pilot signal from the adjacent cell.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] Especially this invention relates to the hand-off technique in the boundary of the frequency hierarchy in the case of having two or more frequency hierarchies, and equipment in the digital cellular system of CDMA method about the mobile-communications system of CDMA (Code Division Multiple Access; code division multiple access) method.

[0002]

[Description of the Prior Art] In the digital cellular system of CDMA method based on IS-95 means of communications which U.S. TIA (Telecommunications Industry Association; Telecommunications Industry Association) specifies, the frequency of the two or more floor layer according to traffic density is prepared. For example, many frequency hierarchies are prepared for the high area of the traffic like a city area, and there is employment gestalt for which a small number of frequency hierarchy is prepared in the low area of the traffic like the suburbs.

[0003] make a move place cell report to a move machine, and the method of changing to the frequency which is preparing the adjoining cell (hand-off), and carrying out is conventionally used by installing the equipment which transmits only the pilot (Pilot) signal of the same frequency as the hierarchy of a self-cell to the cell which adjoins on the frequency hierarchy boundary which shows the boundary of each frequency when it has two or more frequency hierarchies in the digital cellular system of CDMA method Or the method gives the equipment which can measure the field strength from the move machine which is using the frequency which is not assigned to this cell for the adjoining cell, and a system carries out [ the method ] a hand-off to the frequency which the cell which recognizes a move place cell from the instrumentation result, and adjoins is preparing is used.

[0004]

[Problem(s) to be Solved by the Invention] However, such a conventional hand-off method has the following troubles. When there is a frequency which is not prepared compared with an adjoining frequency hierarchy, I understand that the 1st trouble needs to furnish the equipment which only the pilot signal of an applicable frequency transmits, and there is. Or it is necessary to furnish the equipment which measures the field strength of the move machine which is using the frequency which does not exist in a self-cell. Therefore, in any case, the object for installation costs increases.

[0005] I understand that time is required by hand-off execution and the term when a voice quality is bad becomes long as a result, and there is the 2nd trouble. This ground is for performing a measurement operation of the field strength of a move machine, after a base station receives a degradation report of the purport that voice deteriorated from a move machine, when measuring the field strength from a move machine. Furthermore, possibility that a move machine will move to the service area outside of the circle also becomes high by hand-off execution.

[0006] I understand that the time to hand-off execution becomes long compared with other methods after a move machine performs a degradation report to a base station, in order to perform field strength measurement of a move machine in all neighboring cells and to determine the cell of a move place, and the 2nd trouble which was described above for this reason becomes much more remarkable, and there is the 3rd trouble. The purpose of this invention aims at offering the hand-off technique and equipment in CDMA cellular system which enabled it to carry out the hand-off between frequencies to the frequency hierarchy currently prepared during connection the both sides of a cell and a move place cell, without using incidental equipment in a frequency hierarchy boundary.

[0007]

[Means for Solving the Problem] In order to attain such a purpose, the hand-off technique in CDMA cellular system by this invention Answer a degradation report of the operating frequency from a move machine, judge whether an operating frequency is a frequency hierarchy boundary, and when an operating frequency is a frequency hierarchy boundary The frequency currently prepared during the communication the both sides of a cell and a contiguity cell is chosen. It is characterized by having each step which performs the hand-off between frequencies within a cell during a

communication using the selected frequency, answers the notice of the move place cell from a move machine based on the on-the-strength measurement result of the pilot signal from a contiguity cell, and performs the hand-off between cells.

[0008] The hand-off equipment in CDMA cellular system by this invention Move machine, Two or more base stations where a frequency hierarchy has the cell prepared individually, and performs the aforementioned move machine and radio in the aforementioned cell, The aforementioned base station is connected and it has the control unit which controls the hand-off between frequencies of the aforementioned move machine, and the hand-off between cells. the aforementioned control unit A degradation report of a store means to store the frequency configuration information for every frequency hierarchy for every cell, and the operating frequency from the aforementioned move machine is answered. When a judgment means to judge whether an operating frequency is a frequency hierarchy boundary based on the frequency configuration information stored in the aforementioned memory, and a judgment result show that an operating frequency is a frequency hierarchy boundary A frequency-selective means to choose the frequency currently prepared for the contiguity cell from the frequencies currently prepared for the cell during the communication based on the frequency configuration information stored in the aforementioned memory, While the hand-off between frequencies of the aforementioned move machine is performed within a cell during a communication using the selected frequency It is characterized by having a hand-off control means to answer the notice of the move place cell from the aforementioned move machine based on the on-the-strength measurement result of the pilot signal from a contiguity cell, and to perform the hand-off between cells of the aforementioned move machine.

[0009] Therefore, when there is a degradation report of the operating frequency from a move machine, it is judged whether an operating frequency is a frequency hierarchy boundary, when an operating frequency is a frequency hierarchy boundary, the frequency which the frequency currently prepared during the communication the both sides of a cell and a contiguity cell is chosen, and was chosen is used, and the hand-off between frequencies is performed within a cell during a communication. Moreover, when there is a notice of the move place cell from a move machine based on the on-the-strength measurement result of the pilot signal from a contiguity cell, the hand-off between cells is performed.

[0010]

[Embodiments of the Invention] Next, this invention is explained with reference to a drawing. Drawing 1 is a system configuration view in the frequency hierarchy boundary of the digital cellular system of CDMA method by one example of this invention. While the move machine 4 communicates by frequency A, the case where it moves to the area of a base station 1 to the base station 2 is shown by this drawing.

[0011] Since required traffic density is high, although two hierarchies of frequency A and frequency B are prepared in the base station 1, since required traffic density is low, only frequency B is prepared in the 2nd base station 2. Base stations 1 and 2 are connected to the base station control unit 3, and the base station control unit 3 controls a communication operation of base stations 1 and 2.

[0012] The memory 31 which stores the frequency configuration information of the data structure which mentions the base station control unit 3 later for every base station, The reference section 32 which performs the reference and the search of frequency configuration information which answer a notice from the move machine 4 and were stored in memory 31, It has the judgment section 33 which judges a frequency hierarchy boundary based on the reference result of the reference section 32, and the hand-off control section 34 which answers a notice from the judgment result and the move machine 4 of the judgment section 33, and performs a hand-off control.

[0013] In addition, a frequency hierarchy boundary does not have the contiguity cell which is preparing the operating frequency of a cell during a communication, and means that a cell is the boundary of an operating frequency during a communication. Drawing 2 shows the connection status of the mobile station 4 after performing the hand-off between frequencies within the cell of a base station 1, and the base stations 1 and 2. In drawing 2 , the move machine 4 has measured the pilot (Pilot) signal of frequency B of a base station 2 within the cell of a base station 1 while it is communicating with the base station 1 by frequency B.

[0014] Drawing 3 is what showed an example of the data structure stored in the memory 31 of the

base station control unit 3 shown in drawing 1, and shows the frequency configuration information 30 of the base station 1 when the base station 1 constitutes homme \*\*\*\*\*. When the index of this frequency configuration information 30 is carried out for example, by frequency A, it turns out that a frequency is a "frequency hierarchy boundary" during use in the cell of a base station 1.

[0015] Moreover, a search of this frequency configuration information 30 reads the information on "contiguity cell owner \*\*" to frequency B. That is, it turns out that another frequency B currently prepared for the same cell is used also in the contiguity cell.

[0016] Next, an operation of the system constituted as mentioned above is explained using drawing 4. In a base station 1, it cannot notify that a base station 2 is a contiguity cell as a contiguity cell information on frequency A to the move machine 4. For this reason, the move machine 4 notifies the pilot-signal on-the-strength measurement message (Pilot Strength Measurement Massage) which shows the thing which frequency A of a base station 1 exceeds default value, and has deteriorated, and that there is no neighboring cell which is preparing frequency A when it moves between a base station 1 and the base station 2, communicating by frequency A to the base station control unit 3 through a base station 1 (step S11).

[0017] The reference section 32 of the base station control unit 3 answers a notice from the move machine 4, and searches the frequency configuration information 30 which has the data structure shown in drawing 3 (step S12). Based on this reference result, as for the judgment section 33, frequency A present in use judges whether it is a frequency hierarchy boundary (step S13). When a judgment result shows a frequency hierarchy boundary, it is judged that the base station control unit 3 needs to carry out the hand-off of the move machine 4 to the frequency of "contiguity cell owner \*\*" according to the frequency configuration information 30 of drawing 3.

[0018] Next, if the reference section 32 searches the frequency configuration information 30 shown in drawing 3 and it discriminates that frequency B is a candidate as a frequency of "contiguity cell owner \*\*", the hand-off control section 34 will perform the hand-off to frequency B within the cell of a base station 1 (step S14). By the hand-off to frequency B, as shown in drawing 2, while the move machine 4 continues a communication by the base station 1 and frequency B, the pilot signal of frequency B of a base station 2 becomes measurable.

[0019] By measuring the pilot signal of frequency B from a base station 2 which satisfies default value, the move machine 4 determines the cell of a base station 2 as a move place cell. In this case, when two or more pilot signals of frequency B are measured, the strongest contiguity cell of signal strength is chosen from two or more contiguity cells for which frequency B was prepared as a move place cell.

[0020] After an appropriate time, as for the move machine 4, frequency B of a base station 1 notifies the thing which default value is exceeded and has been deteriorated and the thing which the pilot signal of frequency B of a base station 2 became the candidate, i.e., the pilot-signal on-the-strength measurement message the cell of a base station 2 indicates it to be to have become the move place, (Pilot Strength Measurement Massage) to the base station control unit 3 through a base station 1 (step S15).

[0021] This notice is answered, the hand-off control section 14 of the base station control unit 3 performs the hand-off from the base station 1 to the base station 2 of the move machine 4 (step S16), and the talk state of a mobile station 4 is held by this. On the other hand, when it judges with the cell of a base station 1 not being the hierarchy boundary of frequency A at step S13, while it has been frequency A, the hand-off of the move machine 4 is performed in a move place cell.

[0022]

[Effect of the Invention] According to this invention, the following effect is done so as explained above. The 1st effect of this invention is to be able to suppress the equipment investment at the time of a system construction. In all the cells of a frequency hierarchy boundary, when the frequency currently prepared for the adjoining cell is not preparing a self-cell, it installs the equipment which can send only the pilot signal of this frequency, or depends the ground on it not being necessary to install the equipment which measures the field strength of a move machine.

[0023] The 2nd effect of this invention can shorten the duration to hand-off execution, and it is to enable processing of a hand-off demand of many move machines while the probability which can maintain a telephone call becomes high. The ground is based on it not being necessary to perform the

electric-field measurement request to the contiguity cell for every move machine which is performed with a base station control unit etc. in the case of the system which installs the equipment which can measure the field strength of a move machine.

## CLAIMS

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[Claim(s)]

[Claim 1] Answer a degradation report of the operating frequency from a move machine, judge whether an operating frequency is a frequency hierarchy boundary, and when an operating frequency is a frequency hierarchy boundary The frequency currently prepared during the communication the both sides of a cell and a contiguity cell is chosen. The hand-off between frequencies is performed within a cell during a communication using the selected frequency. The hand-off technique in CDMA cellular system characterized by having each step which answers the notice of the move place cell from a move machine based on the on-the-strength measurement result of the pilot signal from a contiguity cell, and performs the hand-off between cells.

[Claim 2] The step which judges whether it is the aforementioned frequency hierarchy boundary in the hand-off technique in CDMA cellular system according to claim 1 is the hand-off technique in CDMA cellular system characterized by having the step which searches the frequency hierarchy boundary information corresponding to a frequency during use with reference to the frequency configuration information memorized beforehand in memory.

[Claim 3] The step which chooses the aforementioned frequency in the hand-off technique in CDMA cellular system according to claim 1 is the hand-off technique in CDMA cellular system characterized by having the step which searches the frequency currently prepared during the communication the both sides of a cell and a contiguity cell with reference to the frequency configuration information beforehand memorized by memory.

[Claim 4] It is the hand-off technique in CDMA cellular system characterized by consisting of an information which shows whether the frequency on which the aforementioned frequency configuration information is prepared for each cell in the hand-off technique in CDMA cellular system according to claim 1 is a frequency hierarchy boundary, and an information which shows whether the frequency currently prepared for each cell is also prepared for the contiguity cell.

[Claim 5] A move machine and two or more base stations where a frequency hierarchy has the cell prepared individually, and performs the aforementioned move machine and radio in the aforementioned cell, The aforementioned base station is connected and it has the control unit which controls the hand-off between frequencies of the aforementioned move machine, and the hand-off between cells. the aforementioned control unit A degradation report of a store means to store the frequency configuration information for every frequency hierarchy for every cell, and the operating frequency from the aforementioned move machine is answered. When a judgment means to judge whether an operating frequency is a frequency hierarchy boundary based on the frequency configuration information stored in the aforementioned memory, and a judgment result show that an operating frequency is a frequency hierarchy boundary A frequency-selective means to choose the frequency currently prepared for the contiguity cell from the frequencies currently prepared for the cell during the communication based on the frequency configuration information stored in the aforementioned memory, While the hand-off between frequencies of the aforementioned move machine is performed within a cell during a communication using the selected frequency Hand-off equipment in CDMA cellular system characterized by having a hand-off control means to answer the notice of the move place cell from the aforementioned move machine based on the on-the-strength measurement result of the pilot signal from a contiguity cell, and to perform the hand-off between cells of the aforementioned move machine.

[Claim 6] It is the hand-off equipment in CDMA cellular system characterized by consisting of the 1st information which shows whether the frequency on which the aforementioned frequency configuration information is prepared for each cell in the hand-off equipment in CDMA cellular system according to claim 5 is a frequency hierarchy boundary, and the 2nd information which shows whether the frequency currently prepared for each cell is also prepared for the contiguity cell.

[Claim 7] Hand-off equipment in CDMA cellular system characterized by having a reference means to answer a degradation report of the operating frequency from the aforementioned move machine, to search the 1st information corresponding to an operating frequency from the aforementioned frequency hierarchy information stored in the aforementioned memory in the hand-off equipment in CDMA cellular system according to claim 6, and to output to the aforementioned judgment means.

[Claim 8] Hand-off equipment in CDMA cellular system characterized by having the reference means which an operating frequency searches the frequency currently prepared during the communication the both sides of a cell and a contiguity cell from the 2nd information on the aforementioned frequency configuration information stored in the aforementioned memory when it was shown that it is a frequency hierarchy boundary, and a judgment result outputs to the aforementioned frequency-selective means in the hand-off equipment in CDMA cellular system according to claim 6.